WHAT IS CLAIMED IS:

Sub B1 1. A servo system for controlling the formation of geometric shapes in materials by moving a tool relative to a workpiece along multiple axes of movement, comprising:

a plurality of motors respectively associated with said multiple axes, each of said motors providing relative movement between the tool and the workpiece along an associated one of said axes;

a plurality of feedback devices respectively associated with said plurality of motors for providing feedback information indicative of at least one of the position and velocity of the tool along an associated axis; and

a single computational resource for receiving feedback information from each of said feedback devices and controlling the operation of each of said motors to provide coordinated relative movement between the tool and the workpiece along each of said multiple axes.

B 2. The servo system of claim 1 wherein said single active processor ~~computational resource~~ comprises a single microprocessor.

B 3. The servo system of claim 1 wherein said active processor ~~computational resource~~ produces said coordinated relative movement of the tool by controlling said motors in a cyclic manner, wherein each cycle comprises a sequential reading of feedback information and generation of a motor control signal for each of the axes being controlled.

26

Sub [illegible] B2

[illegible]. A method for providing coordinated movement of a device along multiple axes of motion by means of a single computational resource, comprising the steps of:

a) determining desired movement of the device along each of said axes of motion for successive increments of time;

b) carrying out one cycle of control for one of said increments of time, said cycle including the steps of:

i) determining at least one of a desired position and desired velocity of the device along one of said axes;

ii) detecting at least one of the actual position and actual velocity of the device along said one axis;

iii) calculating at least one of a position error and a velocity error along said one axis for said increment of time;

iv) generating a control signal to produce movement along said one axis that is effective to reduce said error; and

v) sequentially repeating steps i, ii and iii for each of the other axes; and

c) repeating step b for each of the successive increments of time.

5. The method of claim 4 wherein said control signal is a pulse width modulated signal.

6. The method of claim 5 wherein said step of generating a control signal includes the steps of:

determining a center value indicative of the average width of the pulse width modulated signal over plural previous cycles of operation;

computing a response based on said error and detecting whether said response is less than or greater than a reference value;

increasing said center value when said response is greater than said reference value and decreasing said center value when said response is less than said reference value; and

summing said center value and said response to determine the width of said pulse width modulated signal.

7. The method of claim ~~4~~ 6 wherein said step of determining desired movement includes the steps of:

parametrically representing the path of movement of the device along one axis for successive periods of time;

determining the coefficients of a polynomial which describes at least a portion of said parametric representation;

computing recursive values for at least position and velocity at the beginning of a period of time from said coefficients; and

storing said recursive values in a table.

8. The method of claim 7 further including the steps of computing a recursive value for acceleration from said coefficients, and storing said value in said table.

37

9. The method of claim 8 further including the steps of computing a recursive value for change of acceleration from said coefficients, and storing said value in said table.

10. The method of claim 8 further including the step of computing desired position for successive increments of time by cyclically summing said stored velocity value with said stored position value, to compute a new position value, summing said stored acceleration value with said stored velocity value to compute a new velocity value, and updating said table with said new values.

11. A method for generating a geometric design in a tangible form, comprising the steps of:

parametrically representing the design along respective axes for successive units of measure, where each axis corresponds to a dimension of the design;

for each axis, determining the coefficients of a polynomial which describes at least a portion of the parametric representation;

for each axis, computing from said coefficients recursive values for at least position and change of position per unit of measure;

storing said recursive values in a table;

recursively summing the stored values for successive units of measure to compute new position values; and

representing each of the position values along the respective axes in a tangible media.

12. The method of claim 11 further including the steps of computing a second order value for change of position from said coefficients, and storing said value in said table.

13. The method of claim 12 wherein said recursive summing step includes the step of computing desired positions for successive units of measure by cyclically summing said stored change of position value with said stored position value, to compute a new position value, summing said stored second order value with said stored change of position value to compute a new change of position value, and updating said table with said new values.

14. The method of claim 11 wherein said tangible media is a block of formable material and said representing step comprises removing some of the material from the block, with a tool, at locations determined by said position values.

a

15. The method of claim ~~14~~ 11 wherein said units of measure comprise increments of time.

16. The method of claim 11 wherein said tangible media is a display screen comprised of pixels and said representing step comprises changing the display values of pixels which are determined by said position values, to provide a visible representation of the design on the screen.

17. The method of claim 16 wherein said units of measure are proportional to the spacing between pixels on said display screen.

add a 47